

Introduction:

In science writing, the very first task you should do is to write definitions. Sometimes you are required to define a person, in other cases, you are asked to define an instrument, a noun, a technical term etc. To write a definition, you often use a relative clause to clarify the noun/pronoun defined.

In this context you have here Reading passage about matter and measurement followed by comprehension questions, and grammar in use part you have review of relative clauses and relative adverbs, and how to write a simple definition.

The whole lesson, matter and measurement, is selected to be taught in English. They aim to provide students with reading and writing practice to prepare them to be able to read a relatively long passage and give extended answers in English. After completing this, students should be able to: understand and use the English terms related to describing different forms of matter and measurement and use the relative clauses and relative adverbs to write a definition.

Matter and Measurement

Matter, in science, is the general term applied to anything that has the property of occupying space and the attributes of gravity and inertia. In classical physics, matter and energy were considered two separate concepts that lay at the root of all physical phenomena. Modern physicists, however, have shown that it is possible to transform matter into energy and energy into matter and have thus broken down the classical distinction between the two concepts. When dealing with a large number of phenomena, however, such as motion, the behavior of liquids and gases, and heat, scientists find it simpler and more convenient to continue treating matter and energy as separate entities.

Certain elementary particles of matter combine to form atoms; in turn, atoms combine to form molecules. The properties of individual molecules and their distribution and arrangement give to matter in all its forms various qualities such as mass, hardness, viscosity, fluidity, color, taste, electrical resistivity, and heat conductivity, among others. In philosophy, matter has been generally regarded as the raw material of the physical world, although certain philosophers of the school of idealism, such as the Irish philosopher George Berkeley, denied that matter exists independent of the mind.

Matter exists in three states: solid, liquid and gas. A solid, for example a stone, has a definite shape and a definite volume; a liquid, for example oil, has definite volume but no definite shape; a gas, for example hydrogen (H), has neither definite shape nor volume. Water can exist in all three states; below 0°C as a solid (ice); between 0°C and 100°C as a liquid (water); and above 100°C as a gas (vapor). All matter consists of elements such as zinc (Zn) or oxygen (O), or of compounds such as nitric acid (HNO₃) or sulphur dioxide (SO₂).

When we measure quantities of matter, we may use the fundamental units of time (e.g. the second), mass (e.g. the kilogram) and length (e.g. the meter). Or we may use the units such as area (e.g. m²) or volume (e.g. cm³) or density (e.g. g/cm³). These are known as derived units. The area of a rectangle is found by multiplying the length by the width. The volume of a cylinder is equal to $\delta \times \text{radius}^2 \times \text{height}$ ($V = \delta r^2 h$). The density of a substance is equal to the mass divided by the volume ($d = m/v$). We use the terms specific density or relative density to indicate density relative to the density of water. The table of densities below shows that mercury (Hg) has a density of 13.6g/cm³. This means that a cubic centimeter of mercury has 13.6 times the mass of a cubic centimeter of water.

Substance	Density (g/cm ³)
-----------	------------------------------

Gold	19.3
mercury	13.6
Aluminum	2.7
Water	1.0
Ice	0.92
Hydrogen*	0.00009
Air*	0.0013

* at standard temperature and pressure (*Adapted from different sources*)

COMPREHENSION QUESTION

Exercise 1: Answer the following questions by referring to the reading passage.

1. How is matter generally defined?

.....

2. Were the concepts on matter and energy in classical physics no longer valid? Why?

.....

3. What decides the qualities of matter?

.....

4. What do many philosophers consider matter as?

.....

5. How many states can matter exist in? What are they?

.....

Exercise 2: Complete each of the following statements with words/ phrases from the reading passage

1. Matter is a general term applied to anything that has the of occupying space

2. Matter and energy were considered two separate

3. Modern have shown that it is possible to transform matter into energy

4. Scientists find it simpler and more to continue treating matter and energy as separate entities.

5. Certain particles of matter combine to form atoms

6. The properties of molecules and their distribution and arrangement give to matter various qualities.

7. In philosophy, matter has been regarded as the raw material of the physical world.

8. The Irish philosopher George Berkeley..... that matter exists independent of the mind.

9. We use the terms specific density or relative density to density relative to the density of water.

10. This that a cubic centimeter of mercury has 13.6 times the mass of a cubic centimeter of

water.

Exercise 3: *Decide whether each of the following statements is true (T), false (F) or with no information to clarify (N).*

1.Matter is seen as anything that occupies space and has gravity and inertia.
2.In classical physics, matter and energy were studied separately.
3.Modern physicists have shown that matter can be changed into energy and vice versa.
4.Atoms are made up by certain elementary particles of matter.
5.Such qualities of matter as mass, hardness, viscosity...are controlled by the properties of individual molecules and their distribution and arrangement.
6.In general, philosophers consider matter as the raw materials of the physical world.
7.Matter exists in three states: solid, liquid, and gas at the same time.
8.The fundamental units of measurement come from the derived ones.
9.Specific density is the one which has been put in comparison with that of water.
10.The volume of a substance can be found by dividing the mass by its density.

GRAMMAR IN USE

Review of relative clauses

A) A relative clause is also known as an adjective clause. It is a subordinate clause with the function of modifying a noun/ noun phrase or a pronoun.

Example:

1. Science (pure science) is a term which is used to denote systemized knowledge in any field.
2. Applied science is the term that is used to refer to the search for practical uses of scientific knowledge.
3. Neil Armstrong was the first person who walked on the Moon.
4. Here, we should distinguish pure science from technology through which applications are realized.
5. Newton whom many of us, scientists have respected used not to be a good student a tall.
6. Newton, whose discovery of the theory of gravity was very strange, has been the pioneer in Mechanics Physics.
7. The book of which the cover has been torn is a very famous one written by David Halliday.

From the above examples, we can see that the noun phrases *a term, the term, the first person; technology and Newton* are respectively modified by relative clauses

1. **which** is used to denote systemized knowledge in any field.
2. **that** is used to refer to the search for practical uses of scientific knowledge.
3. **who** walked on the Moon.
4. through **which** applications are realized.
5. **whom** many of us, scientists have respected.
6. **whose** discovery of the theory of gravity was very strange.

7. **of which** the cover has been torn.

B) You can easily realize that these clauses begin with **which/ that/ which/ who/ whom/ whose**. These are called **relative pronouns**. They function as pronouns, and at the same time, show the relationship between the modified noun/pronoun and other elements in the sentence. For example the first relative clause, listed above, shows the relationship between the subject and its complement (*science* and *term*).

By the functions and implications of these pronouns in each the above sentences, we can classify them into groups as in the following table.

Types Functions	For persons	For both	For non-persons
	Subject	Who	That
Object	Whom/who	That/û*	Which
Possessive	Whose	Whose	Whose/of which

Combine each of the following pairs of sentences into one sentence with a proper relative pronoun.

1. A group will carry out this investigation. This group will be organized.
.....
2. A machine is in the next room. The machine will make calculations.
.....
3. Barnard operates on the human heart. He is a heart surgeon.
.....
4. Computers are now helpful in a wide range of applications. Their functions are various.
.....
5. His articles will be published soon. His article is on the subject of scientific experimental methods.
.....
6. Many people’s lives rely on kidney machines. They can still run their lives for a long time.
.....
7. Marie Curie had a happy family life. Her devotion to science is very important.
.....
8. Most of our food consists of animal and plant cells. These cells contain a high proportion of water.
.....
9. Scientists are now facing a lot of matters. One of the matters is that of environmental pollution.
.....
10. The doctor has saved a lot of lives. His patients are normally heart attacked.
.....

11. The edition of the world science magazine this month is very interesting. Its cover is the picture of a virtual nuclear reactor.

.....

12. The method is rather simple. It should be followed.

.....

13. The students missed the start of the experiment. They were late for class.

.....

14. The temperature of the ambient air is very important to this experiment. It should be always kept at 15 0C.

.....

15. There is one more important question today. We must discuss the question thoroughly.

.....

16. We eat some farm birds. They are known as poultry.

.....

17. We have helped thousands of patients. Many of them have difficulty in language production.

.....

18. We must obtain data for the report. The data must be of great importance.

I) Relative clauses with relative adverbs

1) In unit one, you did review relative clauses with relative pronouns, in this unit you will have one more chance to review relative clauses with relative adverbs.

Example

a) The laboratory where experiments are conducted must be kept clean all the time.

b) The time when we should conduct the experiment has not been decided yet.

c) That Physics studies both universe and human being is the reason why I choose it to study for my life.

Each of the above sentences has a relative clause starting with a relative adverb:

a) **where** experiments are conducted

b) **when** we should conduct the experiment

c) **why** I choose it to study for my life.

2) From the examples, it is deduced that relative adverb

a) **where** is used to modify a nouns referring to a place;

b) **when** is used to modify the nouns referring to time; and

c) **why** is used to modify the noun *reason*.

3) However, there is difference among these relative adverbs in forming defining and non- defining relative clauses

3.1. Non – defining relative clauses

When and **where** are used in non- defining relative clauses

Example

- a) You have to read the report next week, **when** the meeting is chair- manned by the president of our society.
- b) The earth, **where** we are living, has always been a mystery objective for scientists.
- c) Last year, **when** he got help from sponsors, was the most successful year for him since the start of his study in mechanics.

3.2. Defining clause

a) **When** and **where** are used in defining relative clauses, but each of these clauses modifies a special group of nouns.

□ **When** follows the word *time* or other time notion as *day, week, month, year*.

Example:

1. The time when we make the observations must be long enough.
2. The day when I started the first lesson on Physics was very impressive.
3. 1642 is the year when Newton, Sir Isaac was born.

Note

Adverb **When** can be replaced with pronoun **which** and an appropriate preposition such as *in, at* or *on*.

The above examples can be rewritten in this way:

1. The time **during which** we make the observations must be long enough.
2. The day **on which** I started the first lesson on Physics was very impressive.
3. 1642 is the year **in which** Newton, Sir Isaac was born.

□ **Where** follows the word *place* or other words referring to a place such as *room* or *street* and the two words *situation* and *stage*

Example:

1. The place where we do experiment is called a laboratory.
2. The room where lectures are given is called the lecture hall.

Note

Adverb **where** can be replaced with pronoun **which** and an appropriate preposition.

The above examples can be rewritten in this way:

1. The place in which we do experiment is called a laboratory.
2. The room in which lectures are given is called the lecture hall.

b) Adverb **why** follows the noun *reason*

Example

1. The reason why you did not succeed was because you had not well prepared for it.
2. Their conservations are the reason why they failed.

Exercise 1: Combine each of the following pairs of sentences into one sentence using an appropriate relative adverb and the word given.

1. Our universe and human beings are studied in an area. The area is science.

Science.....

2. It was the year 1704. In this year, Newton had his second famous works named *Opticks* published.

1704 was the year.....

3. You do experiments in a room. We call that room a laboratory.

The room

4. It was the year 1792. France set up a new system of measurements in this year.

The year 1792

5. It is the International Bureau of Weights and Measurements near Paris. The standard meter is kept there.

The International Bureau

6. Seven basic units were first defined in 1971. In this year, the 14th International Conference on Weights and Measures was held.

The year 1971.....

7. It was the year 1959. In this year, a yard was officially defined as being 0.9144 meter.

The year 1959 was the year

8. It was in the year 1960. A new standard meter was found out, basing on light wavelength.

1960 was the year.....

9. 1983 was an important year. In this year, standard meter was officially defined as the distance that light wave can travel in a given time.

1983 was

10. The English and metric systems of measurements are both in used in one country. That country is the U.S.

The U.S. is

11. People prefer to use the metric system. It is because this system is simpler and more convenient to use.

The reason.....

.....

12. Both English and metric systems of measurements can be used at the same time. There are many situations for this application.

There are

13. He failed to give correct answer to the question. It is because he did not know how to convert the unit of length in English system of measurements.

The reason

14. Physics is an important field. Most of the universal and human issues are discussed in this field.

Physics is.....

15. Each week students have to go to the workshop. They do a lot of practice there.

Weekly,

II) Participle adjectives

Each English verb has two participles (Refer to **Unit two**) which can function as adjectives, present participle being active adjective, and past participle being passive adjective. This means, the present participle can modify noun with the function that it can tell the feature of the noun itself while the past participle tells something about the noun that comes from outside the noun.

Example:

1. *training* program -> the program of training
2. *sounding* device -> the device for sounding
3. *filtering* paper -> the paper for filtering
4. *given* time -> the time which is given
5. *measured* block -> the block which has been measured
6. derived units -> the units which have been derived

Exercise: Give the appropriate form of the verb (either in present or past participle) to complete each of the following sentences.

1. The (choose) seven units in 1971 are defined as basic units.
2. The (measure)..... jar is used when we want to measure the volume of irregular objects.
3. The (travel) path of any object can be measured.
4. The conversion of English system of measurements confuses me. I am thoroughly (confuse).....
5. No one may attend the lecture except the (invite) guests.
6. The (exist)..... matter that makes scientists wonder is how to maintain natural resources.
7. Physics is a very (stimulate) subject because once you get your hands down to it, you start to think hard of our universe and ourselves.
8. The (freeze) water has lower density than liquid water. 9. Outstanding students always have (inquire)..... minds.
10. The (contaminate) air has great influence on the success of the observations.

III) Writing definitions

In science writing, the very first task you should do is to write definitions. Sometimes you are required to define a person, in other cases, you are asked to define an instrument, a noun, a technical term etc.

To write a definition, you often use a relative clause to clarify the noun/pronoun defined.

Example:

1. A barometer is an instrument which is used to measure atmospheric pressure.
2. Science is the term which is used to denote systemized knowledge in any field.
3. A scientist is a person who studies science.

Combining each of the clauses in section A with a suitable one in section B to make a definition on

each branch of science.**Section A**

1. Archaeology	9. Information Science
2. Architecture(computerscience)	10. Linguistics
3. Biology	11. Mathematics
4. Chemistry	12. Meteorology
5. Earth Science	13. Physics
6. Economics	14. Political Science
7. Geography	15. Psychology
8. History	

is a branch of science which/that**Section B**

- studies the relationships among quantities, magnitudes, and properties and of logical operations by which unknown quantities, magnitudes, and properties may be deduced.
- deals with the fundamental constituents of the universe, the forces they exert on one another, and the results produced by these forces.
- studies of the composition, structure, properties, and interactions of matter.
- functions as a means of encompassing the growing number of disciplines involved with the study of living forms.
- deals with the distribution and arrangement of all elements of the earth's surface.
- is the scientific study of language.
- , in its broadest sense, is the totality of all past events, although a more realistic definition would limit it to the known past.
- deals with the generation, collection, organization, storage, retrieval, and dissemination of recorded knowledge.
- is concerned with the production, distribution, exchange, and consumption of goods and services.
- is concerned with the planet Earth or one or more of its parts.
- refers to the study of the structure of all or part of a computer system.
- is the scientific study of behavior and the mind.
- is the scientific study of past human culture and behavior, from the origins of humans to the present.
- is the systematic study of and reflection upon politics.
- studies the earth's atmosphere and especially the weather.

01) Asking and describing dimensions of objects:

- Fulfill the table below with appropriate words:

Noun	Adjective
Length	
	Wide
	Deep
Thickness	
	High

- Make questions and give answer with the words from the above table about the dimensions of any object around you

Example: How high is the board? What is the thickness of your book?

3. To ask and describe the dimensions of objects, you can use either **nouns** or their **corresponding adjectives** as in (2), along with suitable interrogative pronouns What or How Then, we have the following patterns:

a) Asking:

HOW	high wide long thick deep	is/ are	noun(s)?
-----	---------------------------------------	---------	----------

Describing:

Noun(s) is/ are	high. wide. long. thick. deep.
-----------------	-------	--

b) Asking:

WHAT is the	height width length depth thickness	of	noun(s)?
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Describing:

THE	height width length depth thickness	of noun(s)	is/ are
-----	---	------------	---------------

c) Asking:

WHAT are the measurements of noun(s)?

Describing:

Noun(s)	is/ are	in	height width length depth thickness
---------	---------	-------	----	---

Or:

Noun(s)	has/ have a/the	height width length depth thickness	of
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Note: With this way of describing, the question may be formed from the verb to measure to ask for the measurements of objects. **How does/ do + noun/nouns + measure?**

Now, describe the dimension of the following object.

a/ w = 1m h = 0.5m l = 1,5m

b/ w = 0.7cm h = 0.35cm l = 1cm

c/ w= 0.07m h = 0.03m l = 0,14m

Describing shapes of objects

1. Complete the table with suitable words

Noun	Adjective
cuboid	
	conical
sphere	
cylinder	
	hemi-spherical
pyramid	
triangle	
	rectangular
square	